



GOVERNMENT OF SAMOA

STUDENT EDUCATION NUMBER

# Samoa Secondary Leaving Certificate

# CHEMISTRY

# 2023

## QUESTION and ANSWER BOOKLET

Time allowed: 3 Hours & 10 minutes

### INSTRUCTIONS

1. You have 10 minutes to read **before** you start the exam.
2. Write your **Student Education Number (SEN)** in the space provided on the top right hand corner of this page.
3. **Answer ALL QUESTIONS.** Write your answers in the spaces provided in this booklet.
4. If you need more space, ask the Supervisor for extra paper. Write your SEN on all extra sheets used and clearly number the questions. Attach the extra sheets to the appropriate places in this booklet.

**NB:** The Periodic Table is attached on page 22 of the exam paper.

STRANDS		Pages	Time (min)	Weighting
<b>STRAND 1</b>	ATOMIC STRUCTURE AND BONDING	2-5	31	17
<b>STRAND 2</b>	QUANTITATIVE CHEMISTRY	6-9	31	17
<b>STRAND 3</b>	INORGANIC CHEMISTRY	10-11	18	10
<b>STRAND 4</b>	ORGANIC CHEMISTRY	12-15	40	22
<b>STRAND 5</b>	PRINCIPLES OF PHYSICAL CHEMISTRY	16-17	18	10
<b>STRAND 6</b>	OXIDATION AND REDUCTION	18-21	42	24
<b>TOTAL</b>			<b>180</b>	<b>100</b>

Check that this booklet contains pages 2-23 in the correct order and that none of these pages are blank.

**HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

For Questions 1 to 3, choose and write the LETTER of the correct answer in the box provided.

1. Isotope is defined as:

- A. the dense central region of an atom.
- B. similar atoms with different mass numbers.
- C. the smallest particle in a shell.
- D. the nuclear particle with no charge.

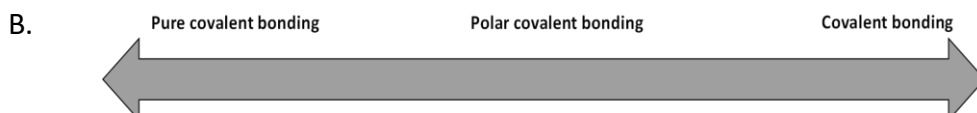
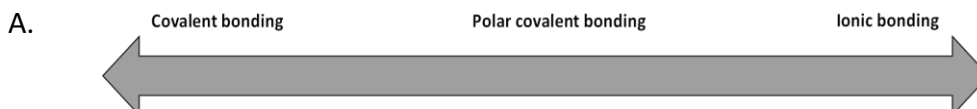
SL 1

2. The atomic radius of an element is:

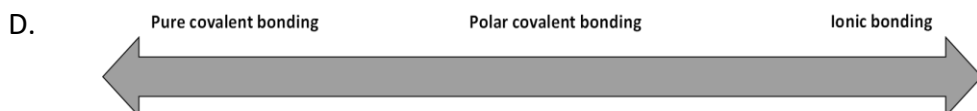
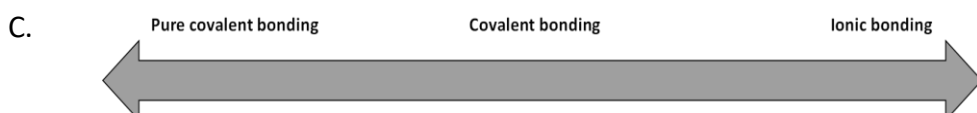
- A. a measure of how strongly electrons are attracted to the nucleus of an atom.
- B. a measure of how weak electrons are attracted to the nucleus of an atom.
- C. the distance between an atom's nucleus and outer electron shell.
- D. the distance between an atom's nucleus and inner electron shell.

SL 1

3. Which of the following diagram of the bonding continuum is correct?




SL 1



4. Explain why  $\text{NH}_3$  is a polar molecule.

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SL 2

5. State the electron configuration for calcium.

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SL 2

6. Draw a shape of the carbon dioxide molecule.



SL 3



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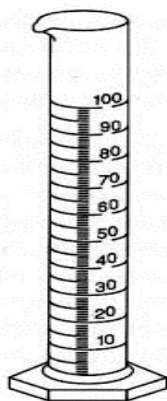
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For Questions 9 to 11, choose and write the LETTER of the correct answer in the box provided.

9. The piece of glassware shown below is called the:



- A. conical flask.  
B. beaker.  
C. pipette.  
D. graduated measuring cylinder.

SL 1

10. Standard solution is defined as the:

- A. solution with an unknown concentration.  
B. solution with a known concentration.  
C. solution with no units.  
D. solution with known units.

SL 1

11. Titre is defined as the:

- A. fixed volume of liquid delivered by a pipette.  
B. fixed mass of solid weighed.  
C. minimum volume of a solution needed to reach the endpoint in a titration.  
D. maximum volume of a liquid in a burette.

SL 1

12. Describe the colour changes of the common indicator (e.g. phenolphthalein or methyl orange) when the end point of the titration is reached.

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SL 2

13. An unknown mass of sodium hydroxide pellets were dissolved in a 200mL water to give a concentration of 0.05 mol/L.

Calculate the mass of the sodium hydroxide pellets.

**M(Na) = 23 g/mol**

**M(O) = 16 g/mol**

**M(H) = 1 g/mol**

SL 2

14. Calculate the concentration of the following solution, before and after dilution.

**0.5 mol NaCl in 500mL solution is diluted by adding 500mL of water.**

SL 3

15. Magnesium burns in air to form magnesium oxide. The equation for the reaction is:



Calculate the mass of magnesium carbonate that will be needed to produce 8.8 g of CO<sub>2</sub>.

**M(Mg) = 24 g/mol**  
**M(H) = 1 g/mol**

**M(C) = 12 g/mol**  
**M(O) = 16 g/mol**

**M(Cl) = 35.5 g/mol**

SL 3



16. Discuss the use of standard solutions and titrations in industries in real-life situations.

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SL 4

17. State the type of bonding formed by elements in Period 3 on the Periodic Table.

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SL 1

18. Give an example of an acidic oxide.

\_\_\_\_\_

SL 1

19. Describe the reaction of water with basic and acidic oxides.

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SL 2

20. Write a balanced equation for the reaction of nitric acid (dilute) and iron (II) carbonate.

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SL 3

21. Explain why ice is less dense than water.

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SL 3

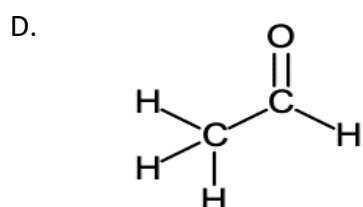
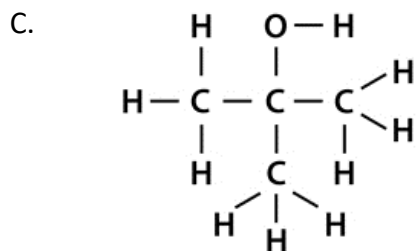
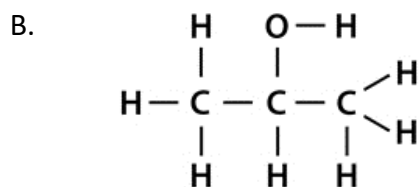
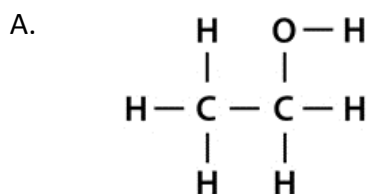
For Questions 22 and 23, choose and write the LETTER of the correct answer in the box provided.

22. Which of the following is the functional group for ketones?

- A. -CO  
 B. -COOH  
 C. -COO-  
 D. -CHO

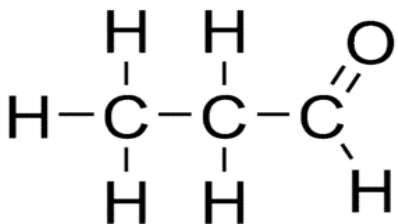
SL 1

23. Which of the following is secondary alcohol?




SL 1

24. State the IUPAC name of the compound below:



SL 2

IUPAC name: \_\_\_\_\_

25. Describe an environmental problem caused by polythene and PVC products.

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SL 2

26. List any TWO of the common properties of esters.

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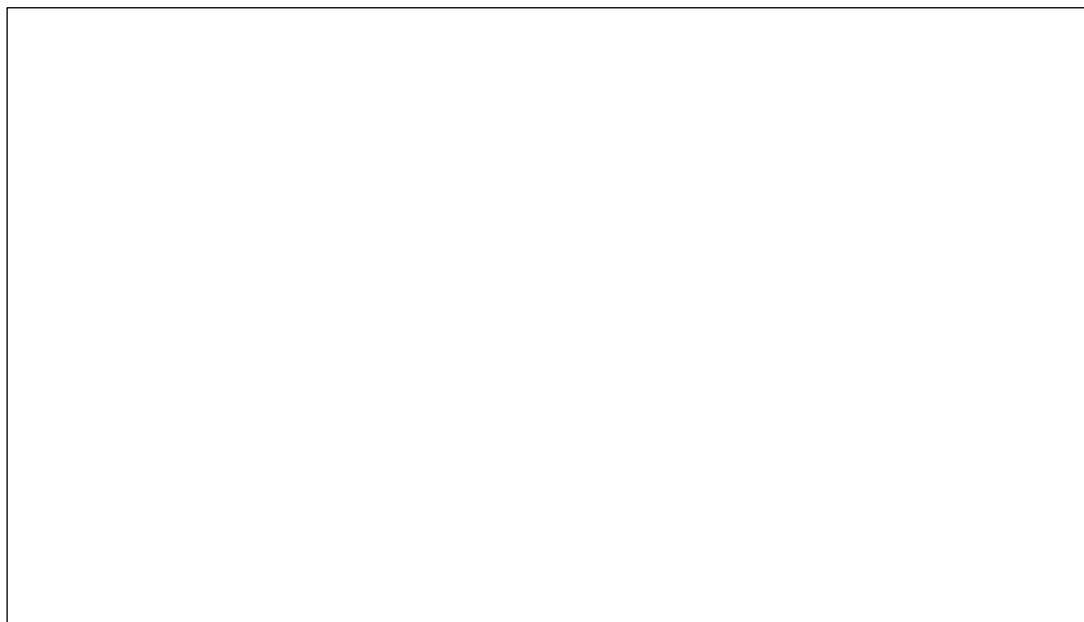
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SL 2

27. Draw the cyclic structure of glucose.



SL 3

28. Describe an observation when propan-1-ol is warmed with a dilute acidified potassium dichromate solution.

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SL 3

29. Discuss why aldehydes have higher melting and boiling points than alkanes with similar molecular mass.

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SL 4

30. The preparation of reagent X is as follows:

***Aqueous silver nitrate (a few mL) is placed in a clean test tube and 1 drop of NaOH is added. The precipitate that forms is dissolved by adding just enough dilute ammonia.***

Discuss an observation when reagent X is warmed with a few drops of butanal solution.

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SL 4

For Questions 31 and 32, choose and write the LETTER of the correct answer in the box provided.

31. Hess' Law is the:

- A. energy released due to a chemical reaction.
- B. energy absorbed due to a chemical reaction.
- C. energy change due to a chemical reaction is dependent on the route taken but depends only on the nature of the reactants and products.
- D. energy change due to a chemical reaction is independent of the route taken but depends only on the nature of the reactants and products.

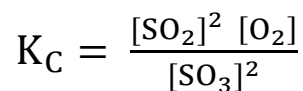
SL 1

32. Amphiprotic substances are substances that:

- A. act as proton donors only.
- B. act as proton acceptors only.
- C. act as both proton donors and proton acceptors.
- D. act as both proton donors and electron acceptors.

SL 1

33. Write a balanced equation for the decomposition of sulfur trioxide.



SL 2

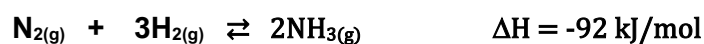
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34. A certain brand of root beer has a hydrogen concentration equal to  $1.9 \times 10^{-5}$  M. Calculate the pH of the root beer.

SL 3

35. A reaction of commercial importance is the production of ammonia ( $\text{NH}_3$ ) from nitrogen ( $\text{N}_2$ ) and hydrogen ( $\text{H}_2$ ).



Explain the effect on the production of ammonia when there is a decrease in pressure on the equilibrium mixture, while the temperature and volume are kept constant.

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SL 3

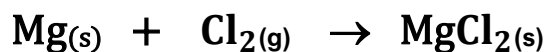
For Questions 36 and 37, choose and write the LETTER of the correct answer in the box provided.

36. The oxidation number of hydrogen in **HOCl** is:

- A. 1
- B. 2
- C. 3
- D. 4

SL 1

37. Which species is reduced in the reaction below?



- A. Mg
- B. Cl
- C. MgCl
- D. None of the above

SL 1

38. List any TWO oxidizing agents.

\_\_\_\_\_

SL 2

39. Describe one observation you would see when a shiny nail (iron) is placed in a copper sulfate solution.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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SL 2

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40. Explain an observation that you would see when  $\text{KMnO}_4$  is reduced.

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SL 2

41. List any equipment or materials used in the investigation of electrons transfer in a redox reaction.

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SL 2

42. Explain the corrosion of metals in vehicles and buildings in terms of oxidation and reduction.

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SL 3

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43. List the compounds of nitrogen in increasing order of oxidation number.



<b>SL 3</b>

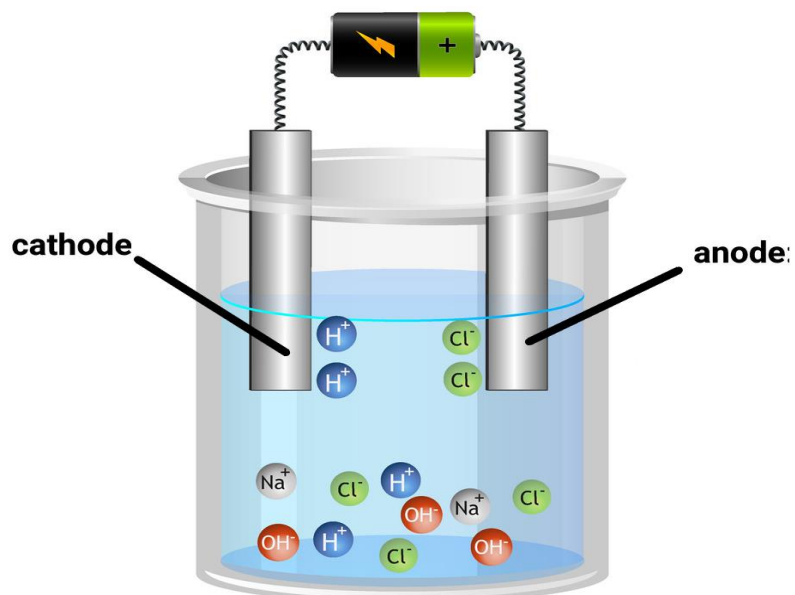
44. A colourless solution of potassium iodide is added to a purple solution of potassium permanganate acidified with hydrochloric acid. The purple colour disappears to leave a light amber solution of iodine (I<sub>2(aq)</sub>).

Write balanced oxidation and reduction half-equations.

<b>SL 4</b>

45. The electrolysis of sodium chloride is an industrial process. The diagram below shows the electrolysis apparatus used for the electrolysis of sodium chloride in a school laboratory.

Discuss the observations made at the cathode and anode electrodes during the electrolysis of sodium chloride.




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SL 4

## Periodic Table of the Elements

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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 11.1%; text-align: center;">1 <b>H</b> Hydrogen 1.008</td> <td colspan="16"></td> <td style="width: 11.1%; text-align: center;">2 <b>He</b> Helium 4.003</td> </tr> <tr> <td style="text-align: center;">3 <b>Li</b> Lithium 6.941</td> <td style="text-align: center;">4 <b>Be</b> Beryllium 9.012</td> <td colspan="14"></td> <td style="text-align: center;">10 <b>Ne</b> Neon 20.180</td> </tr> <tr> <td style="text-align: center;">11 <b>Na</b> Sodium 22.990</td> <td style="text-align: center;">12 <b>Mg</b> Magnesium 24.305</td> <td colspan="14"></td> <td style="text-align: center;">18 <b>Ar</b> Argon 39.948</td> </tr> </table>																		1 <b>H</b> Hydrogen 1.008																	2 <b>He</b> Helium 4.003	3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012															10 <b>Ne</b> Neon 20.180	11 <b>Na</b> Sodium 22.990	12 <b>Mg</b> Magnesium 24.305															18 <b>Ar</b> Argon 39.948																						
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<b>Ru</b> Ruthenium 101.07</td> <td style="text-align: center;">45 <b>Rh</b> Rhodium 102.906</td> <td style="text-align: center;">46 <b>Pd</b> Palladium 106.42</td> <td style="text-align: center;">47 <b>Ag</b> Silver 107.868</td> <td style="text-align: center;">48 <b>Cd</b> Cadmium 112.411</td> <td style="text-align: center;">49 <b>In</b> Indium 114.818</td> <td style="text-align: center;">50 <b>Sn</b> Tin 118.71</td> <td style="text-align: center;">51 <b>Sb</b> Antimony 121.760</td> <td style="text-align: center;">52 <b>Te</b> Tellurium 127.6</td> <td style="text-align: center;">53 <b>I</b> Iodine 126.904</td> <td style="text-align: center;">54 <b>Xe</b> Xenon 131.29</td> </tr> <tr> <td style="text-align: center;">55 <b>Cs</b> Cesium 132.905</td> <td style="text-align: center;">56 <b>Ba</b> Barium 137.327</td> <td style="text-align: center;">57-71 Lanthanides</td> <td style="text-align: center;">72 <b>Hf</b> Hafnium 178.49</td> <td style="text-align: center;">73 <b>Ta</b> Tantalum 180.948</td> <td style="text-align: center;">74 <b>W</b> Tungsten 183.85</td> <td style="text-align: center;">75 <b>Re</b> Rhenium 186.207</td> <td style="text-align: center;">76 <b>Os</b> Osmium 190.23</td> <td style="text-align: center;">77 <b>Ir</b> Iridium 192.22</td> <td style="text-align: center;">78 <b>Pt</b> Platinum 195.08</td> <td style="text-align: center;">79 <b>Au</b> Gold 196.967</td> <td style="text-align: center;">80 <b>Hg</b> Mercury 200.59</td> <td style="text-align: center;">81 <b>Tl</b> Thallium 204.383</td> <td style="text-align: center;">82 <b>Pb</b> Lead 207.2</td> <td style="text-align: center;">83 <b>Bi</b> Bismuth 208.980</td> <td style="text-align: center;">84 <b>Po</b> Polonium [208.982]</td> <td style="text-align: center;">85 <b>At</b> Astatine 209.987</td> <td style="text-align: center;">86 <b>Rn</b> Radon 222.018</td> </tr> <tr> <td style="text-align: center;">87 <b>Fr</b> Francium 223.020</td> <td style="text-align: center;">88 <b>Ra</b> Radium 226.025</td> <td style="text-align: center;">89-103 Actinides</td> <td style="text-align: center;">104 <b>Rf</b> Rutherfordium [261]</td> <td style="text-align: center;">105 <b>Db</b> Dubnium [262]</td> <td style="text-align: center;">106 <b>Sg</b> Seaborgium [266]</td> <td style="text-align: center;">107 <b>Bh</b> Bohrium [264]</td> <td style="text-align: center;">108 <b>Hs</b> Hassium [269]</td> <td style="text-align: center;">109 <b>Mt</b> Meitnerium [268]</td> <td style="text-align: center;">110 <b>Ds</b> Darmstadtium [269]</td> <td style="text-align: center;">111 <b>Rg</b> Roentgenium [272]</td> <td style="text-align: center;">112 <b>Cn</b> Copernicium [277]</td> <td style="text-align: center;">113 <b>Uut</b> Ununtrium unknown</td> <td style="text-align: center;">114 <b>F1</b> Flerovium [289]</td> <td style="text-align: center;">115 <b>Uup</b> Ununpentium unknown</td> <td style="text-align: center;">116 <b>Lv</b> Livermorium [298]</td> <td style="text-align: center;">117 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Indium 114.818	50 <b>Sn</b> Tin 118.71	51 <b>Sb</b> Antimony 121.760	52 <b>Te</b> Tellurium 127.6	53 <b>I</b> Iodine 126.904	54 <b>Xe</b> Xenon 131.29	55 <b>Cs</b> Cesium 132.905	56 <b>Ba</b> Barium 137.327	57-71 Lanthanides	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.948	74 <b>W</b> Tungsten 183.85	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.22	78 <b>Pt</b> Platinum 195.08	79 <b>Au</b> Gold 196.967	80 <b>Hg</b> Mercury 200.59	81 <b>Tl</b> Thallium 204.383	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.980	84 <b>Po</b> Polonium [208.982]	85 <b>At</b> Astatine 209.987	86 <b>Rn</b> Radon 222.018	87 <b>Fr</b> Francium 223.020	88 <b>Ra</b> Radium 226.025	89-103 Actinides	104 <b>Rf</b> Rutherfordium [261]	105 <b>Db</b> Dubnium [262]	106 <b>Sg</b> Seaborgium [266]	107 <b>Bh</b> Bohrium [264]	108 <b>Hs</b> Hassium [269]	109 <b>Mt</b> Meitnerium [268]	110 <b>Ds</b> Darmstadtium [269]	111 <b>Rg</b> Roentgenium [272]	112 <b>Cn</b> Copernicium [277]	113 <b>Uut</b> Ununtrium unknown	114 <b>F1</b> Flerovium [289]	115 <b>Uup</b> Ununpentium unknown	116 <b>Lv</b> Livermorium [298]	117 <b>Uus</b> Ununseptium unknown	118 <b>Uuo</b> Ununoctium unknown		
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## SSLC CHEMISTRY

2023

*(For Scorers only)*

STRANDS		Weighting	Scores	Check Scorer	AED check
<b>STRAND 1</b>	ATOMIC STRUCTURE AND BONDING	17			
<b>STRAND 2</b>	QUANTITATIVE CHEMISTRY	17			
<b>STRAND 3</b>	INORGANIC CHEMISTRY	10			
<b>STRAND 4</b>	ORGANIC CHEMISTRY	22			
<b>STRAND 5</b>	PRINCIPLES OF PHYSICAL CHEMISTRY	10			
<b>STRAND 6</b>	OXIDATION AND REDUCTION	24			
<b>TOTAL</b>		<b>100</b>			